SAP ERP Versus SAP APO: Which Production Planning Functionality Do I Use, and How Can I Be Successful?

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SCMO2
What We’ll Cover …

- Reviewing SAP production planning options offered in SAP ERP and SAP Advanced Planning & Optimization (SAP APO)
- Learning how advanced capabilities differ from material requirements planning (MRP) and capacity requirements planning (CRP) functionality in SAP ERP
- Examining the latest production planning and detailed scheduling (PP/DS) features and functions delivered with SAP APO, including heuristics, optimization, and block planning methods
- Identifying the prerequisites for migrating from production planning functionality in SAP ERP to PP/DS
- Wrap-up
SAP Supply Chain Planning Functionality

- Basic SAP production planning functionality available in both platforms
- APO provides robust and advanced functionality to support forecasting, capacity planning, and production scheduling
- Both platforms are integrated with ERP execution functionality

SAP Supply Chain Execution
SAP APO Architecture

Application Link Enabling
Model Generator, Mapping, Connectivity

Available To Promise
Demand Planning
Supply Network Planning
TP/VS
PP/DS

BW

SC Cockpit
liveCache

APO Solvers

ECC
Legacy R/3 OLTP
Non R\3 OLTP
Production Planning in PP vs. APO

SAP PP
- Flexible Planning
- Long Term Planning
- MRP
- CRP
- Production Scheduling
- ATP Check

SAP APO
- Demand Planning
- Supply Network Planning
- Supply Network Planning or PPDS
- Production Planning/ Detailed Scheduling
- GATP

Supply Chain Execution
## ERP Production Planning Sequence

### SAP ECC

<table>
<thead>
<tr>
<th>Flexible Planning</th>
<th>Demand management</th>
<th>Plannedindreqmts</th>
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<tr>
<td><strong>Sales &amp; Distribution (SD)</strong></td>
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<td><strong>Sales order</strong></td>
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<td><strong>Production Planning (PP)</strong></td>
<td><strong>Release, Confirmations</strong></td>
<td><strong>Planned order</strong></td>
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<td><strong>Transfer order</strong></td>
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</table>
APO Planning Sequence with SAP ERP Integration

SAP ERP

Flexible Planning

Demand management

Sales & Distribution (SD)

Sales order

Production Planning (PP)

Release, Confirmations

Planned order
Process order

Purchasing (MM)

Purchase requisition
Purchase order
Stock transport requisition

Logistics Execution System (LES)

Execution

Delivery
Transfer order

APO

Demand Planning (DP)

Plannedindreqmts

Sales order

Supply Network Planning (SNP)
Prod. Plng & Det. Schedlng (PP/DS)

Planned order
Process order

Conversion

Purchase requisition
Purchase order

Stock transport requisition
Stock transport order

Deployment

Transp. Plng & Veh. Schedlng (TP/VS)

Planned delivery
Delivery
Planned shipment/Shipment

Deployment
APO Planning Process Flow

Production Planning Flow

MASTER DATA

Demand Planning (DP)

Supply Planning

S&OP Integration SNP

Supply Network Planning

Materials Requirements Planning SNP/PPDS

Detailed Production Scheduling PPDS

Manufacturing Execution PP
PP/DS Order Pegging

Supports dynamic and fixed pegging

Finished product

Semi-Finished product

Component
Raw material
Packaging

Sales order/
Planned ind. reqmts
Planned order
Dependent requirements
Planned order
Dependent requirements
Purchase requisition

SAP ERP MRP
Pegging Across the Order Network — Overview

PP/DS scheduling capability make use of pegging relationships to schedule operations and orders.
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• Wrap-up
SAP ERP Production Planning and Scheduling

- **Production Planning using SAP PP Materials Requirements Planning (MRP)**
  - Can plan all materials, but typically non-key components, MRO
  - Provides infinite time-phased planning and consumption-based planning using top-down approach
  - Evaluate plant-level results using real-time Individual/Collective Stock Requirements List, static MRP List
Basic Production Planning Capability
Net Requirements Calculation

Production Planning capability provided by both ERP and APO also consider lot sizes and safety stock settings.

**Requirement elements**

- Sales Orders
- Forecast
- Safety Stock
- Dependent Demands

**Receipt elements**

- Planned Orders
- Production or Process Orders
- Purchase Requisitions
- Purchase Orders

Net requirement = Requirement elements - Stock on Hand + Receipt elements
MRP with SAP ERP

- Demands are the sales orders and the planned independent requirements
- Orders are created time-phased from the requirement date
- MRP is infinite planning without considering capacity constraint

Considerations with MRP in SAP ERP
- MRP is based on a specific plant or MRP area
  - Low-level code determination limited to plant
- Planning scope sequence must be maintained for distribution planning
- Selection criteria supports material, MRP controller/plant
- Business-specific planning solution possible only with an enhancement
SAP ERP Production Planning and Scheduling

- **Production Planning using SAP PP Master Production Scheduling (MPS)**
  - Option for planning finished goods and key components
  - Uses materials with MRP Type M0 – M4, BOMs, work centers/resources, routings/recipes
  - Provides infinite time-phased planning using top-down approach, with separate capacity planning step
  - Similar evaluation as MRP
SAP ERP Stock Requirements List Transaction (MD04)

- Displays requirements and receipts
- Starting inventory
- Branch to inventory information
SAP ERP — Capacity Requirement Planning (CRP)

- Capacity leveling is a two-step process
  1. Capacity evaluation (overload vs. under load)
  2. Manual dispatch to the work centers or the resources
SAP ERP Dispatching Screen

- Planning Table
- Manual Order Dispatching – assign work center

![Planning Table: SAPSFCG001 Finite scheduling forw./all functs.activ](image)

- Work centers - Available capacity
- Orders available to dispatch

Manually place order on w/c with available capacity
SAP ERP Production Planning and Scheduling

- **Capacity Planning using SAP PP Capacity Evaluation**
  - Review capacity load for single plant work centers in weekly buckets
  - Drill down to individual planned/production orders
- **Detailed Scheduling using SAP PP Capacity Leveling**
  - Dispatch unscheduled operations from the order pool in desired sequence
  - Reschedule dispatched operations using drag & drop or return operations to the order pool and re-dispatch
- **Production Schedule Reporting**
  - Use Order Information System or custom reports
- **Procurement Reporting**
  - Use Purchase Requisition Report and other MM reports
SCM APO Production Planning and Scheduling

- Plans APO-relevant materials, APO resources, and PPM or PDS
- **Master Production Planning using APO SNP**
  - Uses same data as APO SNP Rough-Cut Planning
  - Plans across locations using SNP data view with daily and weekly buckets over shorter horizon
  - Evaluate results in product-based daily/weekly data view and SNP alerts
- **Detailed Production Planning using APO PP/DS**
  - Use multi-step background job to create planned orders and purchase requisitions
  - Evaluate results using the Product View, Product Overview, and PP/DS alerts
**SCM APO Capacity Planning**

- **Capacity Planning using APO SNP**
  - Evaluate capacity loading using resource-based daily, weekly, or monthly data view for key resources across plants
  - Optional resource hierarchies available
  - Capacity leveling heuristic available to resolve periods of over-capacity (2-step approach, like SAP ERP)
  - Optimizer and Capable-to-Match (CTM) planning engines can generate a feasible capacity constrained plan in a single planning run
  - Can consider alternate sources of supply at multiple plants/locations in your network
SAP APO Resource Planning Book

SNP Capacity view

Displays resource utilization per time bucket

Displays order quantity per time bucket
SCM APO Production Planning and Scheduling

- **Capacity Planning using APO PP/DS**
  - Can plan across plants using MRP framework
    - Calculate cross location low-level codes
    - Use quotas to determine supply source
  - Finite Scheduling heuristics and PP/DS optimizer available to use with planning run
  - Plans within one plant location
  - Evaluate capacity loading over shorter term using DS Planning Board Resource chart or Resource Loading chart with daily, weekly, and monthly timescale
  - Filter or highlight bottleneck resources and reschedule operations within DS Planning Board
PP/DS — User Interface

Product View

Detailed Scheduling Board

Alert Monitor
APO Product View — Transaction RRP3

- The Elements tab is the main planning screen
- This screen displays all the requirements and receipts for a product similar to SAP ERP transaction MD04 – stock requirements view
- A significant capability difference is that it supports interactive changes
APO Product View — Interactive Heuristics

- PP/DS provides an option to run multiple different heuristics
- Most heuristics plan receipts elements, but some are designed to perform a specific system function (i.e., quota, create safety stock)
- The heuristic profile defines a library of available heuristics

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<th>heuristic</th>
<th>description</th>
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<td>The MRP multi-level executes a multi-level heuristic that plans down throughout the BOM structure</td>
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<td>MRP Single Level (no lot size), AS</td>
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<tr>
<td>MRP Single Level (lot size)</td>
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<td>SNP&gt;PPDS All (adopt snp stat)</td>
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<td>Change Order Priorities</td>
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<td>Create Safety Stock in SAP liveCache</td>
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<tr>
<td>Delete Safety Stock in SAP liveCache</td>
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<td>MRP Single Level (no lot size), FIFO</td>
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<td>MRP Single Level in 3 Horizons, FIFO</td>
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<tr>
<td>Planning of Standard Lots for Conti-IJO</td>
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</table>

Create Safety Stock in liveCache heuristic will create time phased safety stock values displayed in the product view.

Example of SAP delivered planning heuristics
APO Product Planning Table

- User settings control which charts are loaded for display
- The resource chart displays resource utilization
- Product view: Periodic chart displays plan in time buckets
APO Product Planning Table — Resource Chart

- The resource chart displays resource utilization, capacity requirements in hours, and resource capacity
- This view can be changed to daily, weekly, and monthly buckets
- You can also double click on a week and show all the work orders planned on that resource during that period

<table>
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<tr>
<th>Resource view: Periodic</th>
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<th>Due</th>
<th>W 38 (09...)</th>
<th>W 39 (09...)</th>
<th>W 40 (10...)</th>
<th>W 41 (10...)</th>
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### Detailed Scheduling Planning Board, Planning Version 000

#### Resources Chart

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#### Product Chart

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<tr>
<td>JR8702LGH</td>
<td>HDL CAST S</td>
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</table>
APO Detailed Scheduling Planning Board

- The planning board:
  - Provides graphical tools to manually and automatically schedule and sequence constrained production orders
  - Reviews inventory level
  - Reviews resource utilization
  - Automatically creates a simsession to try out different scenarios
  - Can be accessed from product view or planning table
- The planning board display is controlled by defining a work area
  - It is a pre-defined set of products and resources
    - Defines production planner planning responsibility
- Planning board look and feel is determined by configuration settings
  - Overall profile, DS strategy, heuristic profile, graphic profile ...
SCM APO Detailed Scheduling and Reporting

- **Detailed Scheduling using APO PP/DS**
  - Evaluate production schedule using DS Planning Board Resource chart in hourly or daily timescale
  - Execute manual sequencing, scheduling heuristics and PP/DS optimizer to schedule and re-sequence operations
  - Option to save results to simulation version and evaluate using the Plan Monitor

- **Production Schedule Reporting**
  - Multiple reports for APO-relevant materials and resources
  - Production Supervisors still require ECC reports listing all materials, capacities, and manufacturing instructions

- **Procurement Reporting**
  - Pass procurement proposals to ECC for reporting
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SAP APO PP/DS — Key Capabilities Over SAP ERP

- **Heuristic planning**
  - Production planning heuristic
    - MRP Framework
    - Material constraints planning (bottom up)
    - Block planning

- **Detailed scheduling**
  - Scheduling heuristic
  - Sequence optimization (setup matrix)

- **Online Capable-to-Promise (CTP)**
  - Simulate Production scheduling in conjunction with global Available-to-Promise (ATP) at order entry
  - Alert monitor
Foundation Heuristics

- **Stage Level Heuristic**
  - Calculates low-level code
  - Parameter setting support cross-location low-level code calculation

- **MRP Framework Heuristic**
  - Utilizes low-level code to control planning sequence
  - Can utilize product location heuristic or maintain a default heuristic for all products
Standard Planning Heuristics — SAP Delivered

- Over 60 standard heuristics, with option to add custom logic to planning runs
  - Multi-level production planning
  - MRP Planning with material availability checking
  - Flexible pegging of production to demand
  - Detailed, time continuous planning to the second
- Basis for custom heuristic configuration or custom enhancement development

| SAP_PP_001 | Change Order Manually | /SAPAPO/HEU_ORDER_CHANGE |
| SAP_PP_002 | Planning of Standard Lots | /SAPAPO/HEU_PLAN_STANDARDLOTS |
| SAP_PP_003 | Planning of Shortage Quantities | /SAPAPO/HEU_PLAN_DEFICITS |
| SAP_PP_004 | Planning of Standard Lots in 3 Horizons | /SAPAPO/HEU_P601D_PERIODIC_LOT |
| SAP_PP_005 | Part Period Balancing | /SAPAPO/HEU_PART_PERIOD |
| SAP_PP_006 | Least-Unit Cost Proc.: Ext. Procurement | /SAPAPO/HEU_PUR_PLANNING |
| SAP_PP_007 | Reorder Point Planning | /SAPAPO/HEU_REORDER_POINT_PLAN |
| SAP_PP_008 | Rescheduling: Bottom-Up for Conti- I/O | /SAPAPO/HEU_MIN_PEG_G_SUP_CONT |
| SAP_PP_009 | Rescheduling: Bottom Up | /SAPAPO/HEU_MIN_PEG_G_SUPPLY |
| SAP_PP_010 | Rescheduling: Top Down | /SAPAPO/HEU_MIN_PEG_G_DEMAND |
| SAP_PP_011 | Delete Fixed Pegging Relationships | /SAPAPO/HEU_P601D_FIX_DELETE_NEW |
| SAP_PP_012 | Change Order Priorities | /SAPAPO/HEU_PRIO_CHANGE |
Detailed Scheduling — Heuristics Examples

- Detailed scheduling heuristics help manage the work to schedule production
  - Run heuristics interactively or from planning run
  - Schedule Sequence – move orders according to a specified criteria
  - Remove backlog – take all orders in the past to the current date for rescheduling
  - Schedule Sequence Manually – a manual sequencing table displays all the orders and drag and drop them in the right sequence
  - Bottom up – Uses order pegging to reschedule dependent requirements based on schedule sequence of lower level receipt element
  - Top down – Uses order pegging to schedule lower-level receipt elements based on higher-level planned order dependent requirements
SAP APO PP/DS Scheduling Heuristic

- The active strategy profile controls the scheduling mode (finite/infinite) and scheduling direction (backwards/forwards)

Scheduling result when using a strategy profile maintained with a finite scheduling mode and forward direction

Scheduling Heuristic
SAP APO PP/DS — Block Planning

- Blocks are used to schedule capacity on bottleneck resources by product groups specified by characteristics
- Blocks are defined based on the characteristics of products and resources
- Actual duration is calculated based on the Production Process Models (PPMs) or Product Data Structure (PDS)
Characteristics — Dependent Planning (CDP)

- Characteristic values are passed from the sales order to the planned order for planning and/or scheduling
- Components can be selected using characteristics from material requirements

Sales Orders

Finished Material

Resource

18 Gauge  |  20 Gauge  |  21 Gauge  |  18 Gauge  |  21 Gauge  |  18 Gauge  |  20 Gauge  |  21 Gauge
Optimization: Change of dates/sequences and resource assignment with regard to the following criteria:

- W1 * Total Lead Time
- + W2 * Sum of Setup Times
- + W3 * Sum of Setup Costs
- + W4 * Maximum Delay Costs
- + W5 * Sum of Delay Costs
- + W6 * Sum of Mode Costs

Objective Function = Minimum
Sequence Optimization Using PP/DS Optimizer

<table>
<thead>
<tr>
<th>Product</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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Setup Matrix

Resource Capacity

Lead Time

Sales Orders

Receipts

Setup Costs and Time

Due Date Violation
User-Defined Heuristics
Heuristic Framework

Sliver order challenge: After Finite Planning (Optimization or Schedule Heuristic Run) small orders of the same product are grouped together.

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User-defined heuristics for merging

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After Merging using custom heuristic

Planned Orders
- **Product A**
- **Product B**
## Finite Scheduling — Multiple Steps

### After Optimization

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### Merging Heuristic

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### Squeeze Heuristic

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### After Merging there are gaps between orders

### Forward Scheduling with close gap scheduling mode to remove gaps
### Planning Run Steps — Real-World Scenario

- **Sequential steps with a user-defined selection of:**
  - Products
  - Locations
  - Resources
  - Planners

- **Planning can be carried out as a:**
  - Background job
  - Interactive session with multiple selections
  - Simulation version

### Processing Steps

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### Selection of Products for the Processing Step 01

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**With Planning File Entry**

**Processing Steps**

**Selection Parameter**
PP/DS — Capable-to-Promise

- ATP check during sales order processing
  - Capable-to-Promise invokes Production Planning
- Multi-level check
  - At the end-item and component level
- Generation of new planned orders/purchase requisitions possible
  - Checks available resources and raw materials
The alert monitor configuration contains all the settings that can be manipulated to provide manageable and informative alerts.

This section contains the time profile in which you request the system to look for alerts.

This section contains the actual alert types that you can select.
Alert Monitor — Display

- The alerts can be generated and displayed according to user preferences
- Each alert comes with thresholds level that you can set
- There are also three tiers of alerts: Informational, warning, and error alert definitions for each alert
# APO PP/DS Evaluation — Resource Load

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<th>+ReteTime%</th>
<th>+PrdQueue%</th>
<th>+ReqsTime%</th>
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PP/DS Scope — Planning and Scheduling

CIF – operational functionality
- Setup Master data integration models
- Setup Transaction data integration models
- APO/ECC tools to correct a CIF error

Pre-requisite functionality
- Demand plan placed on plant – can be APO or ECC

Planning heuristic scope
- Low-level code
- MRP framework – parallel planning and alternate heuristic
- Standard lot size planning – utilize product specific lot size rule to determine production run size
- Planning in 3 horizons – define planning horizons and variable lot size rules for near term midterm and long term planning.

Scheduling heuristic scope
- Drag & drop graphical sequencing
- Manual sequencing – determine production sequence in a spreadsheet like format.
- Automatic sequencing – sequence by location product attributes or setup group
- Set planning horizon in PPDS planning board – define planning period subset within planning board time horizon

PP/DS – Display and Understand Results
- Planning board – configure chart display to utilize color to identify planned order sequence. Maintain planned order text to communicate plant specific information.
- Configure chart display to show planned order sequence on resource, inventory chart and product plan.
- Product view – Maintain customer specific display settings

PP/DS Optimizer
- PPDS optimizer creates capacity constrained schedule across BOM level driven by planned orders scheduled on bottleneck resources.
- Setup matrix definition defines preferred scheduling sequence

Exception alerts
- Alert monitor configuration to support exception planning
- Maintain PPDS alert set (SS violation, late order, order shortage)
What We’ll Cover …

- Reviewing SAP production planning options offered in SAP ERP and SAP Advanced Planning & Optimization (SAP APO)
- Learning how advanced capabilities differ from material requirements planning (MRP) and capacity requirements planning (CRP) functionality in SAP ERP
- Examining the latest production planning and detailed scheduling (PP/DS) features and functions delivered with SAP APO, including heuristics, optimization, and block planning methods
  - Identifying the prerequisites for migrating from production planning functionality in SAP ERP to PP/DS
- Wrap-up
Set Up the Core Interface (CIF)

- Master data and transaction data tightly integrated to SAP ERP
- “Core Interface” delivered and supported by SAP
- “liveCache” (RAM based) planning for performance
ERP to APO Planning Data Flow — System Architecture

SAP ERP

Master Data
- Plant
- Material
- Work center
- Production Version

Transaction Data
- Planned Order
- Sales Order
- Purchase Ord.
- Manufacturing Order

SAP APO-SAP ERP Conceptual Design

Master Data
- Location
- Product
- Resource
- PPM /PDS

Transaction Data
- Planned Order
- Sales Order
- Purchase Ord.
- Manufacturing order

SAP APO

PPDS

SNP

DP

Archiving and Reporting

ODS

SAP NetWeaver® BW

Replenishment plan

Forecast

Alerts
SAP ERP and APO Master Data Objects

- SAP ERP data elements are transferred into APO and combined with other data elements to form the Planning master data.
Core Interface — Integration Model Design

- **Integration model dependency**
  - Several integration models are required
  - There is a prerequisite sequence
  - Separate models for master data and transaction data

Integration Model Plant ➔ Integration Model Resources ➔ Integration Model Materials ➔ Integration Model Stock ➔ Integration Model Sales Orders ➔ Integration Model PPM (PDS) ➔ Integration Model Goods Movement ➔ Integration Model Planned Orders ➔ Integration Model Prod. Orders ➔ Integration Model STO
Process Integration

SAP ERP
- Master Data
- Stock
- Sales Order
- Planned Order
- System Creates Manufacturing Order
- Order Release
- Goods Issue
- Confirmation
- Goods Receipt
- TECO the Order

SAP SCM
- Master Data
- Stock
- Sales Order
- Planned Order
- System Creates Manufacturing Order
- Order Release
- Goods Issue
- Confirmation
- Goods Receipt
- TECO the Order

CIF

Production Planning
- Demand Planning
- Forecast

Detailed Scheduling
- Setup Matrix

Production Execution
- Net Requirement Calculation
- Optimization and Sequencing
- Order is Updated
- Order is Deleted
When to Implement APO PP/DS Instead of ERP-PP

- Clients with complex sequencing rules implement PP/DS
  - Automatically create sequenced, constrained production schedule
  - Along with Optimization to minimize change-overs, PP/DS offers step-by-step planning approach with multiple heuristics
  - Possible to do “What-If” analysis before execution
  - Can quickly and easily re-plan when major production issues occur
- In the case of “No Supply,” Capable-to-Promise (CTP) provides better customer service
  - CTP offers real-time visibility of shop floor capacity
  - Global ATP and PP/DS are prerequisite for CTP
- To standardize scheduling tools and approach across all plants
  - Manual scheduling tools in PP/DS are superior to ERP-PP
  - Simplify planning and scheduling tasks, and provide proactive alerts
What We’ll Cover …

• Reviewing SAP production planning options offered in SAP ERP and SAP Advanced Planning & Optimization (SAP APO)
• Learning how advanced capabilities differ from material requirements planning (MRP) and capacity requirements planning (CRP) functionality in SAP ERP
• Examining the latest production planning and detailed scheduling (PP/DS) features and functions delivered with SAP APO, including heuristics, optimization, and block planning methods
• Identifying the prerequisites for migrating from production planning functionality in SAP ERP to PP/DS

• Wrap-up
7 Key Points to Take Home

- SAP ERP PP and MM functionality is available for MPS and MRP planning, and manual capacity leveling
- SAP PP is enhanced with multiple advanced planning engines in SAP APO
- APO Supply Network Planning provides decision support for sourcing, inventory, distribution, and production in a multi-plant network
- PPDS provides flexible planning runs for multiple industry scenarios, with Capable-to-Promise integration to gATP
- The detailed shop floor scheduling tools available through SAP APO PP/DS include manual, graphical, semi automated, automated scheduling, and optimization support
7 Key Points to Take Home (cont.)

- The Core Interface provides seamless integration in real time between SAP ERP and APO
- An integrated Alert Monitor supports powerful, exception-based planning to focus planners on critical issues
Where to Find More Information

- For a more detailed examination of production planning functionality from SAP, join speaker Matt Campbell at Logistics and SCM 2015 in Las Vegas, March 30-April 1, where he will be presenting three sessions, including an updated presentation on SAP ERP vs. SAP APO.
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